

Evaluation of Sample Preservation Methods for Space Missions

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For interplanetary spacecraft that will travel to destinations where future life detection experiments may be conducted or samples are to be returned to earth, we should archive and preserve relevant samples from the spacecraft and cleanrooms for evaluation at a future date. Spacecraft and assembly-room derived samples could prove vital as analytical controls, establishing the cleanliness of the spacecraft and the nature and quantities of contaminant levels. We have begun evaluations and experiments to determine which preservation methods should be used for this purpose. Since we cannot predict what detection methods and analytical techniques will be employed in the future, we began by evaluating preservation methods for currently used analytical and detection methods. These detection methods include: the viable growth of microbes, an energetic molecule biomarker adenosine triphosphate (ATP), cell wall constituents known as endotoxins as detected by the Limulus Amebocyte Lysate assay (LAL), direct microscopy, and molecular biology techniques. The basic objective of this study is to understand the best ways to preserve samples for use with future technology. We want to save materials, small parts, coupons, biological samples in water or buffer, DNA, and isolated microbes. This paper will present research data using samples collected from the Mars 2001 orbiter, Odyssey, and environmental samples collected from the cleanroom, during final assembly. We evaluated the changes in the samples by testing before and after freezing at -80°C . The results show that there are losses in the number of viable microbes after freezing. Two independent studies of pooled cleanroom samples demonstrate good ATP recovery and consistent values after freezing at -20°C .